Stibnite Gold Project EIS Appendix G

Soils and Reclamation Cover Materials

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Appendix G-1: TSRC Methodology

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APPENDIX G-1

Total Soil Resource Commitment Methods

Total Soil Resource Commitment (TSRC): As defined in the Payette and Boise Forest Plans (Forest Service 2003; Forest Service 2010), this is the conversion of a productive site to an essentially non-productive site for a period of more than 50 years. Mining excavations and dumps, roads, dedicated trails, parking lots, and other dedicated facilities (e.g., landfills, borrow sites, surface water management features, etc.) are examples of TSRC. Productivity on these areas range from 0 to 40 percent of natural background. Proposed activities that may affect soil resources are required to meet Standard SWST03 which states:

In an activity area where existing conditions of TSRC are below 5 percent of the area, management activities shall leave the area in a condition of 5 percent or less TSRC following completion of the activities.

In an activity area where existing conditions of TSRC exceed 5 percent of the area, management activities shall include mitigation and restoration so that TSRC levels are moved back toward 5 percent or less following completion of the activities.

Effects are determined for a defined activity area, which for TSRC is “an all-inclusive area where effects to soil commitment could occur or are occurring” (Forest Service 2003; Forest Service 2010). The Forest Plans further describe activity areas as “the smallest logical land area where the effect that is being analyzed or monitored is expected to occur”. The activity area for TSRC has been defined as the National Forest System (NFS) lands within the sixth field hydrologic unit codes (HUCs) within which the SGP takes place. The sixth level classification of HUCs was selected as it is a reasonable extent to which some of the potential indirect effects of the SGP might extend, such as soil erosion and sedimentation. The activity area excludes private lands per established methodology for TSRC analysis on the PNF, which in the case of the mine site is Midas Gold Idaho, Inc. (Midas Gold)’s patented mining claims. The activity area also excludes from the TSRC analysis Inventoried Roadless Areas (IRAs), Research Natural Areas (RNAs), and Wilderness because these areas of NFS lands typically do not meet the “expected to occur” criteria for TSRC analysis.

Because of the unique situation where the SGP proposes various facilities or parts of facilities within IRAs, and because the action alternatives vary the location/footprint of a number of facilities for a variety of reasons, each of the four action alternatives has a slightly different activity area due to those facilities occurring within IRAs. Only the footprint of facilities occurring within IRAs were retained for the activity area (rather than providing a buffer). For instance, for areas of new road construction within an IRA associated with the Burntlog Route, only the limits of the road cut and fill were retained when generating the activity area within the HUCs (the rest of the IRA was eliminated, reducing the overall acreage of the activity area). Retaining only the footprint, as opposed to a buffer, is more conservative to the analysis of TSRC, which ultimately

is focused on the percent of TSRC out of the total area of the activity area (i.e., the larger the activity area, the smaller the proportion of TSRC within that activity area).

The analysis of TSRC considered a total of 16 subwatersheds, in part or in whole (depending on if they are located within NFS lands/forest boundary) and combined the applicable watersheds to create two separate activity areas based on Forest Plan jurisdiction: one for the PNF and one for the BNF; refer to the Figures in **Appendix G-2**.

Existing TSRC Methods

Existing TSRC within the sixteen subwatersheds encompassing where disturbance associated with the SGP would occur was mapped with the use of a geographic information system (ArcGIS) with relevant digital spatial layers including Lidar-generated terrain maps, aerial photographs, road and trail layers, and previous mapping of disturbed areas.

To provide an area calculation of existing TSRC associated with roads, GIS data from the United States Forest Service Natural Resource Manager (NRM) Infra application was used. Polygons were created by buffering centerlines of roads by 12 feet (total width of 24 feet). For trails, a trail layer called “TrailNFS_Publish” from the Forest Service was used. Polygons were created by buffering centerlines of trails by 3.5 feet (total width of 7 feet). Additionally, centerlines for Warm Lake Road, Johnson Creek Road, and Stibnite Road were buffered by 15 feet (total width of 30 feet).

For Lidar-generated terrain maps, a layer called “hillshade_raster_10m_res” was used; hand-digitizing with the aid of aerial imagery of assumed TSRC (e.g., other roads/trails, airplane runways, urban development, parking lots, etc.) was performed using Google Earth and ESRI Imagery base maps.

Existing TSRC within the activity areas are provided in **Tables G-1** through **G-3** (**Tables 4.5-1**, **4.5-4,** and **4.5-9**, respectively, in Section 4.5).

Table G-1 Payette National Forest Subwatersheds, Activity Area, and Existing Total Soil Resources Commitment (Alternatives 1, 2, 3, and 4)

Subwatershed	Subwatershed (acres)	Activity Area (acres)	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
Headwaters East Fork South Fork Salmon River	15,974	5,034	171	3%
Sugar Creek	11,497	2,021	57	3%
No Man's Creek-East Fork South Fork Salmon River[1]	17,885	413	31	1%
TOTAL	**45,356**	**7,468**	**259**	**3%**

Table Source: AECOM 2020

Table Notes:

1 The western portion of the No Man's Creek-East Fork South Fork Salmon River subwatershed is within the BNF. The acreage provided here is only for the area that is within the PNF.

TSRC=Total Soil Resource Commitment.

Table G-2 BNF Subwatersheds, Activity Area, and Existing TSRC (Alternatives 1, 2, and 3)

Subwatershed	Subwatershed Acres	Activity Area Acres	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
No Man's Creek-East Fork South Fork Salmon River[1]	1,837	516	11	2%
Porcupine Creek-Johnson Creek	21,516	2,796	78	3%
Riordan Creek	14,411	883	17	2%
Trapper Creek-Johnson Creek	12,129	2,518	37	1%
Ditch Creek-Johnson Creek	16,222	3,628	48	1%
Burntlog Creek	25,194	9,417	99	1%
Sheep Creek-Johnson Creek	10,403	3,178	28	1%
Lunch Creek-Johnson Creek	15,414	7,322	98	1%
Headwaters Johnson Creek	23,385	10,305	89	1%
Warm Lake Creek	15,093	6,820	160	2%
Six-Bit Creek South Fork Salmon River	15,087	7,105	63	1%
Curtis Creek	17,476	8,280	74	1%
Upper Big Creek	18,436	13,429	103	1%
TOTAL	**206,604**	**76,196**	**904**	**1%**

Table Source: AECOM 2020

Table Notes:

1 The eastern portion of the No Man's Creek-East Fork South Fork Salmon River subwatershed is within the PNF. The acreage provided here is only for the area that is within the BNF.

TSRC=Total Soil Resource Commitment.

Table G-3 BNF Subwatersheds, Activity Area, and Existing TSRC (Alternative 4)

Subwatershed	Subwatershed Acres	Activity Area Acres	Existing TSRC in Activity Area (acres)	Percent Existing TSRC in Activity Area
No Man's Creek-East Fork South Fork Salmon River[1]	1,837	516	11	2%
Porcupine Creek-Johnson Creek	21,516	2,796	78	3%
Riordan Creek	14,411	883	17	2%
Trapper Creek-Johnson Creek	12,129	2,518	37	1%
Ditch Creek-Johnson Creek	16,222	3,628	48	1%
Sheep Creek-Johnson Creek	10,403	3,178	28	1%
Lunch Creek-Johnson Creek	15,414	7,322	98	1%
Warm Lake Creek	15,093	6,820	160	2%
Six-Bit Creek South Fork Salmon River	15,087	7,105	63	1%
Curtis Creek	17,476	8,280	74	1%
Upper Big Creek	18,436	13,429	103	1%
TOTAL	**158,025**	**56,474**	**716**	**1%**

Table Source: AECOM 2020

Table Notes:

1 The eastern portion of the No Man's Creek-East Fork South Fork Salmon River subwatershed is within the PNF. The acreage provided here is only for the area that is within the BNF.

TSRC=Total Soil Resource Commitment.

The activity area excludes private lands per established methodology for TSRC analysis on the PNF, which in the case of the mine site is Midas Gold's patented mining claims.

Table G-4 shows the additional 558 acres of SGP-related disturbance that would occur within Midas Gold's private patented mining claims under Alternative 1 (excluded from the TSRC activity area) of which approximately 338 acres would occur over existing soil disturbance.

Table G-4 Alternative 1 Soil Disturbance within Patented Mining Claims

Soil Disturbance	Total Acreage of Patented Mining Claims (acres)	Soil Disturbance within Mining Claims (acres)	Existing Soil Disturbance Outside Disturbance Footprint[1] (acres)	Total Soil Disturbance in Mining Claims (acres)
Existing Soil Disturbance	1,342	398	--	398
Alternative 1 Soil Disturbance	1,342	558[2]	60	618

Table Source: AECOM 2020

Table Notes:

1 Existing soil disturbance within patented mining claims that is not overlapped by or attributed to the SGP. It is included within the "Total Soil Disturbance in Mining Claims" column.

2 Alternative 1 overlaps approximately 338 acres of existing soil disturbance (which is included in this total).

Table G-5 shows the additional 555 acres of SGP-related disturbance that would occur within Midas Gold's private patented mining claims under Alternative 2 (excluded from the TSRC activity area) of which approximately 334 acres would occur over existing soil disturbance.

Table G-5 Alternative 2 Soil Disturbance within Patented Mining Claims

Soil Disturbance	Total Acreage of Patented Mining Claims (acres)	Soil Disturbance within Mining Claims (acres)	Existing Soil Disturbance Outside Disturbance Footprint[1] (acres)	Total Soil Disturbance in Mining Claims (acres)
Existing Soil Disturbance	1,342	398	--	398
Alternative 2 Soil Disturbance	1,342	555[2]	64	619

Table Source: AECOM 2020

Table Notes:

1 Existing soil disturbance within patented mining claims that is not overlapped by or attributed to the SGP. It is included within the "Total Soil Disturbance in Mining Claims" column.

2 Alternative 2 overlaps approximately 334 acres of existing soil disturbance (which is included in this total).

Table G-6 shows the additional 512 acres of SGP-related disturbance that would occur within Midas Gold's private patented mining claims (excluded from the TSRC activity area) of which approximately 298 acres would occur over existing soil disturbance.

Table G-6 Alternative 3 Soil Disturbance within Patented Mining Claims

Soil Disturbance	Total Acreage of Patented Mining Claims (acres)	Soil Disturbance within Mining Claims (acres)	Existing Soil Disturbance Outside Disturbance Footprint[1] (acres)	Total Soil Disturbance in Mining Claims (acres)
Existing Soil Disturbance	1,342	398	--	398
Alternative 3 Soil Disturbance	1,342	512[2]	100	612

Table Source: AECOM 2020

Table Notes:

1 Existing soil disturbance within patented mining claims that is not overlapped by or attributed to the SGP. It is included within the "Total Soil Disturbance in Mining Claims" column.

2 Alternative 3 overlaps approximately 298 acres of existing soil disturbance (which is included in this total).

Table G-7 shows the additional 563 acres of SGP-related disturbance that would occur within Midas Gold's private patented mining claims under Alternative 4 (excluded from the TSRC activity area) of which approximately 340 acres would occur over existing soil disturbance.

Table G-7 Alternative 4 Soil Disturbance within Patented Mining Claims

Soil Disturbance	Total Acreage of Patented Mining Claims (acres)	Soil Disturbance within Mining Claims (acres)	Existing Soil Disturbance Outside Disturbance Footprint[1] (acres)	Total Soil Disturbance in Mining Claims (acres)
Existing Soil Disturbance	1,342	398	--	398
Alternative 4 Soil Disturbance	1,342	563[2]	58	621

Table Source: AECOM 2020

Table Notes:

1 Existing soil disturbance within patented mining claims that is not overlapped by or attributed to the SGP. It is included within the "Total Soil Disturbance in Mining Claims" column.

2 Alternative 4 overlaps approximately 340 acres of existing soil disturbance (which is included in this total).

Appendix G-2: TSRC Analysis Figures

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APPENDIX G-2

TSRC Analysis Figures

The figures utilized or generated for the analysis of TSRC consist of the following:

- Figure 1 Alternative 1 Surface Disturbance Schedule
- Figure 2 Alternative 1 Reclamation Schedule
- Figure 3 PNF and BNF Activity Areas
- Figure 4 Alternative 1 TSRC Activity Areas and Soil Disturbance
- Figure 5 Alternative 2 TSRC Activity Areas and Soil Disturbance
- Figure 6 Alternative 3 TSRC Activity Areas and Soil Disturbance
- Figure 7 Alternative 4 TSRC Activity Areas and Soil Disturbance

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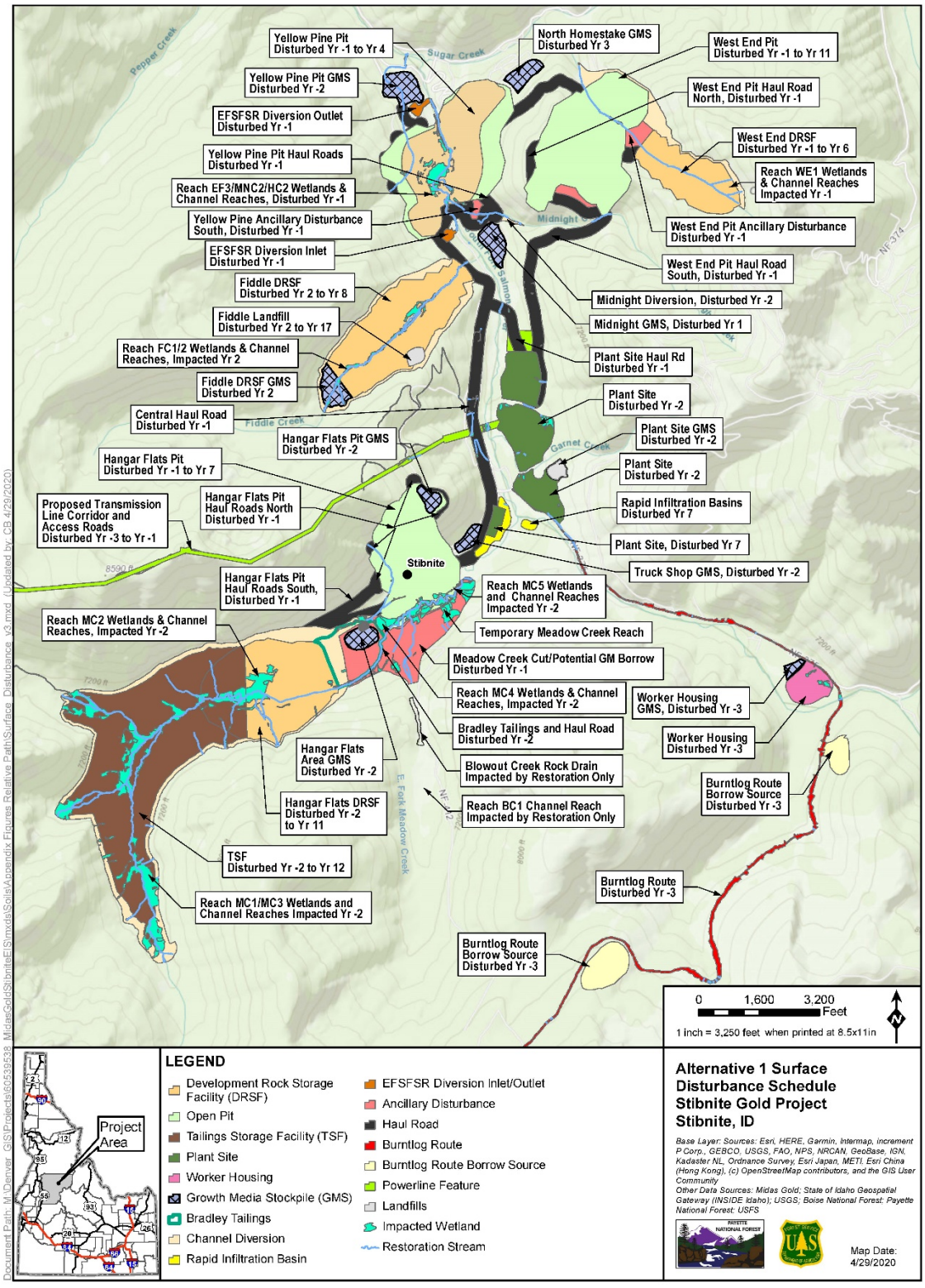

Figure 1 Alternative 1 Surface Disturbance Schedule

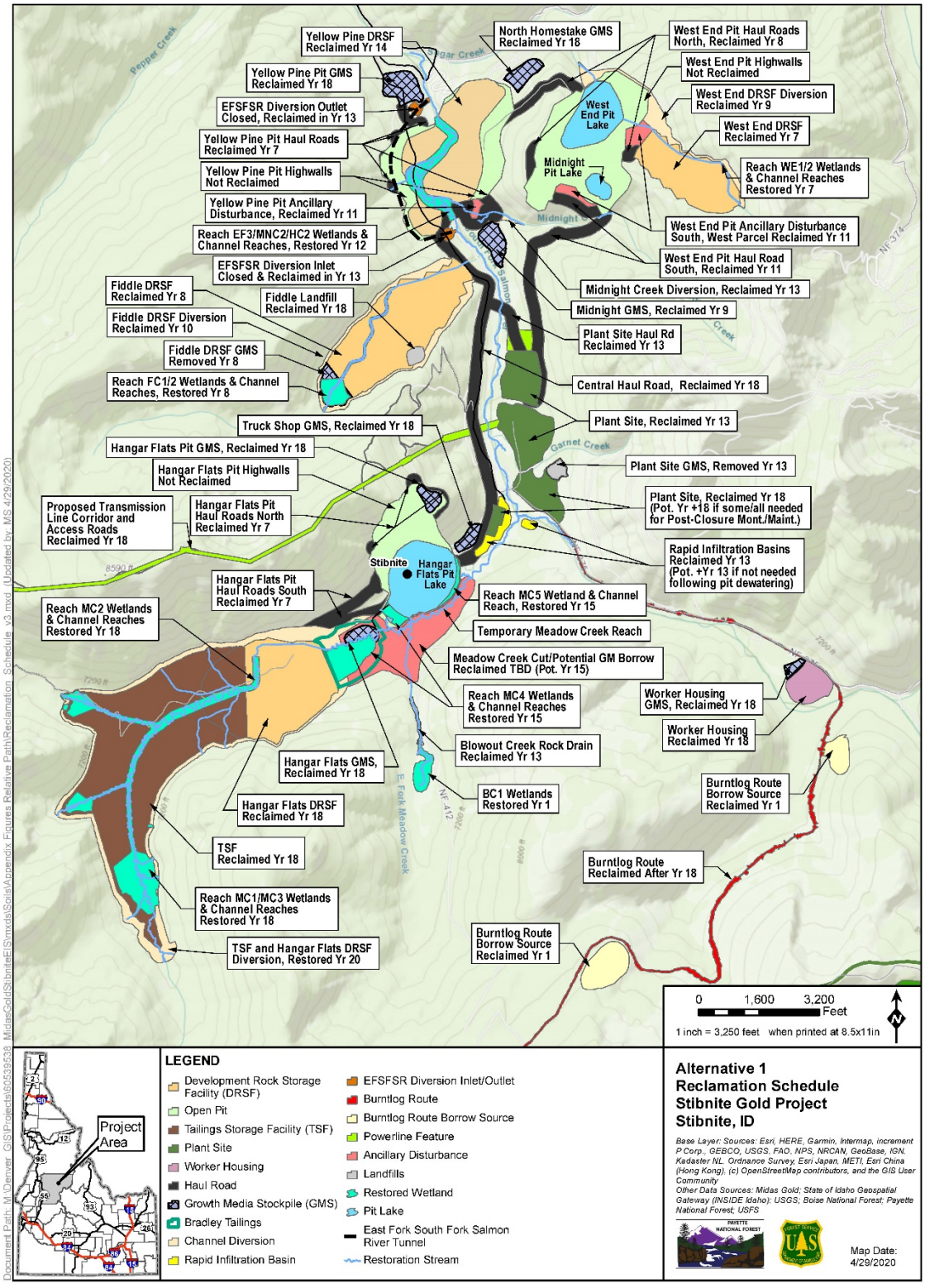

Figure 2 Alternative 1 Reclamation Schedule

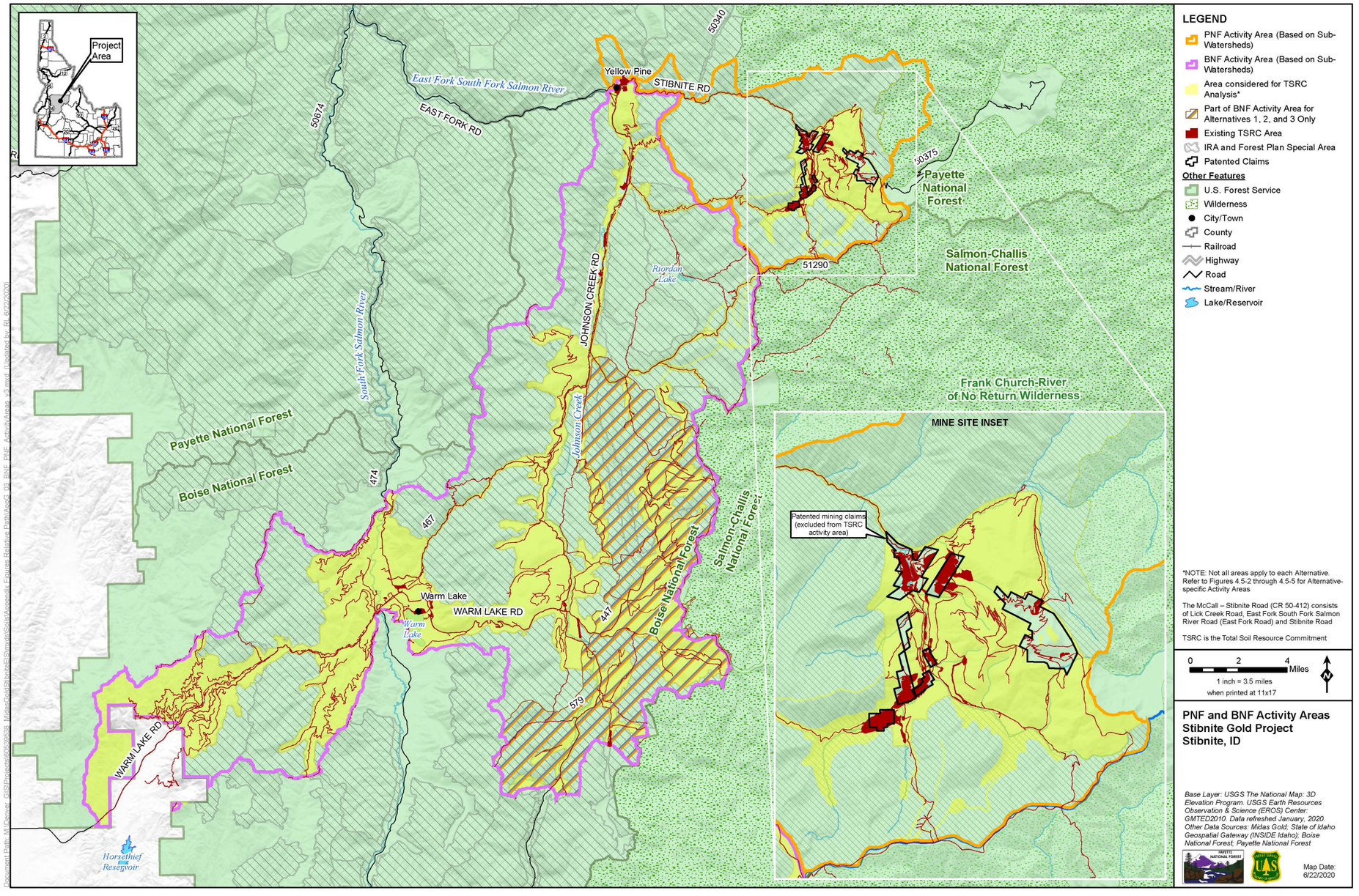

Figure 3 PNF and BNF Activity Areas

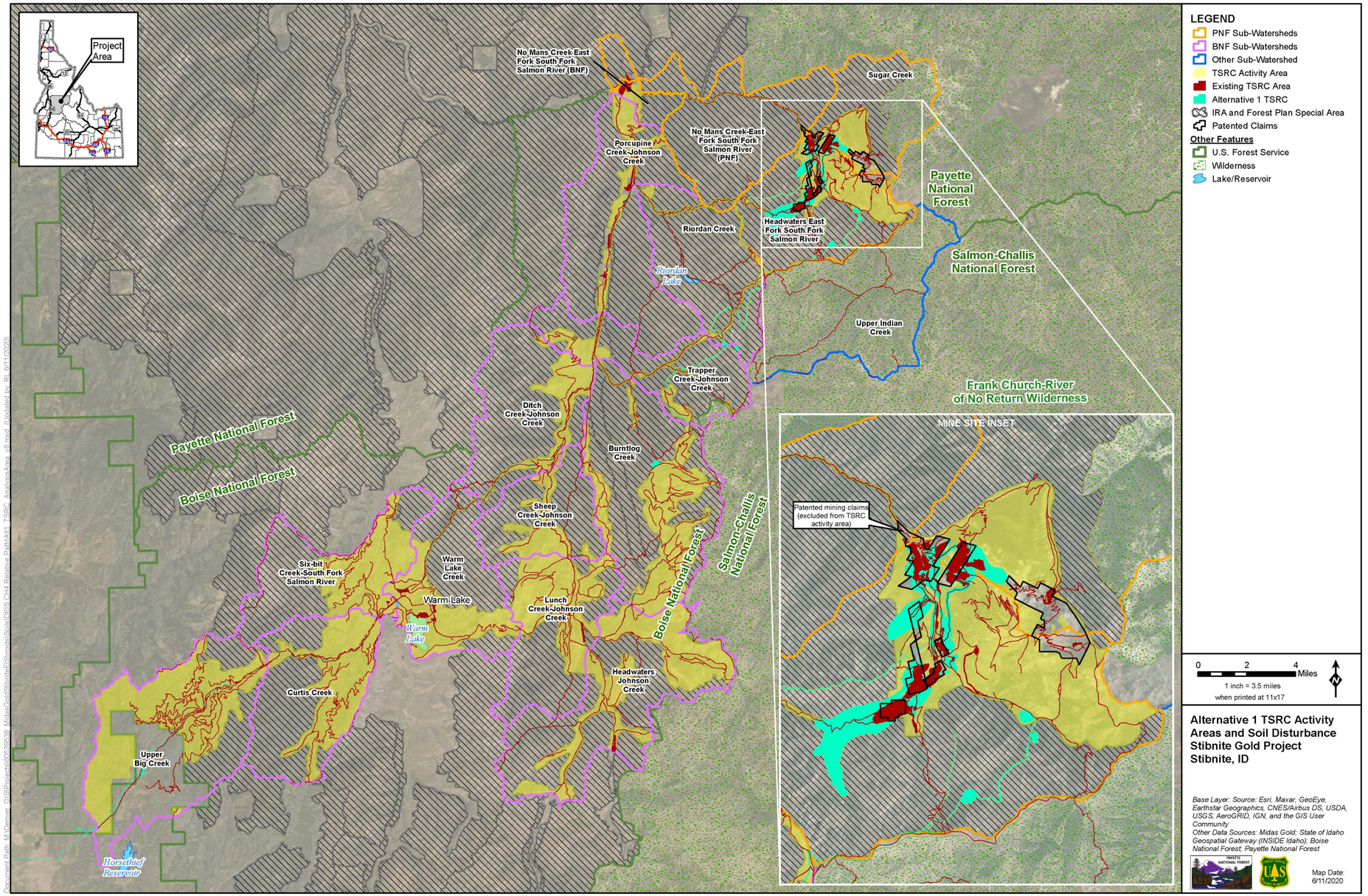

Figure 4 Alternative 1 TSRC Activity Areas and Soil Disturbance

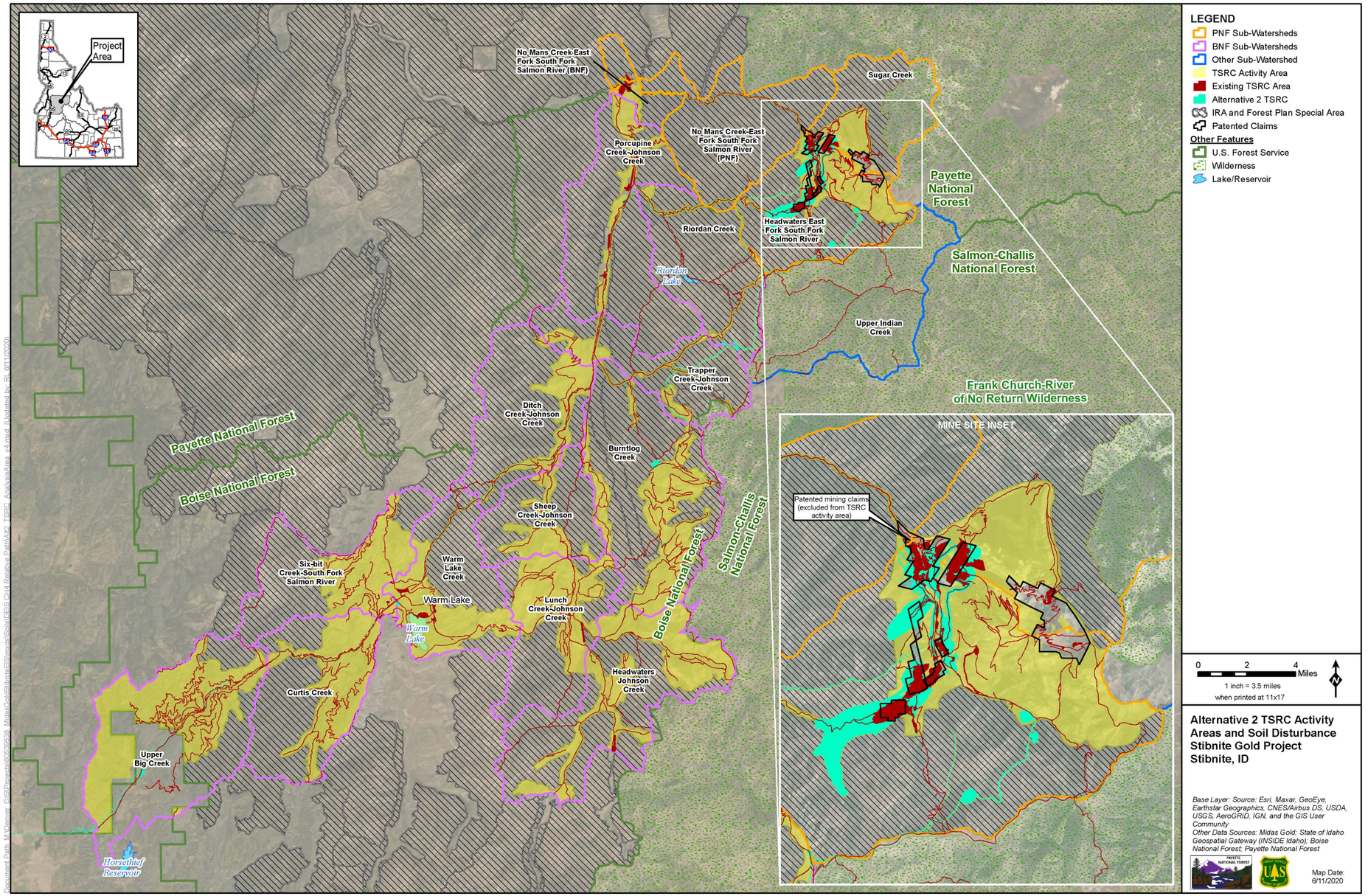

Figure 5 Alternative 2 TSRC Activity Areas and Soil Disturbance

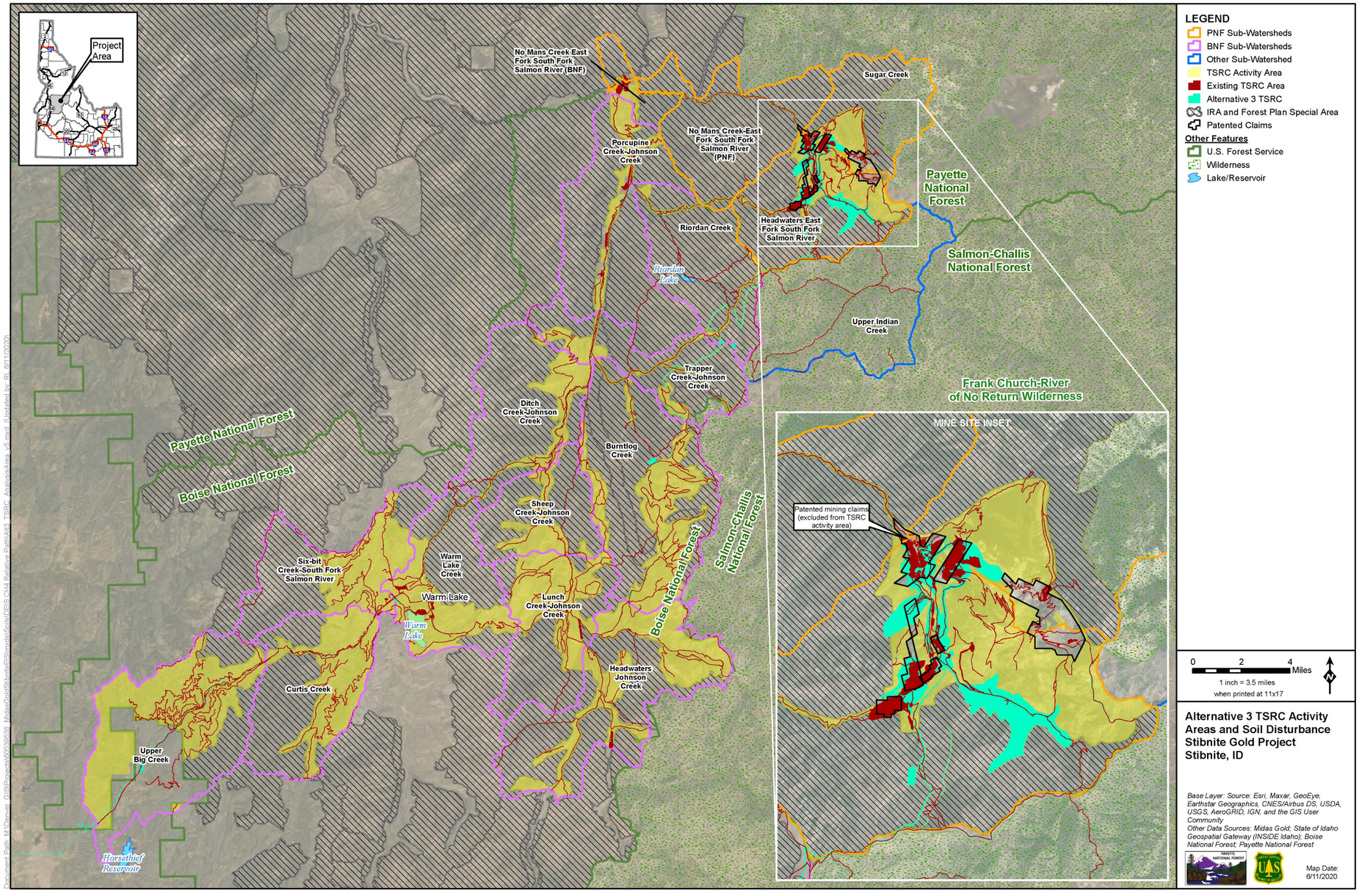

Figure 6 Alternative 3 TSRC Activity Areas and Soil Disturbance

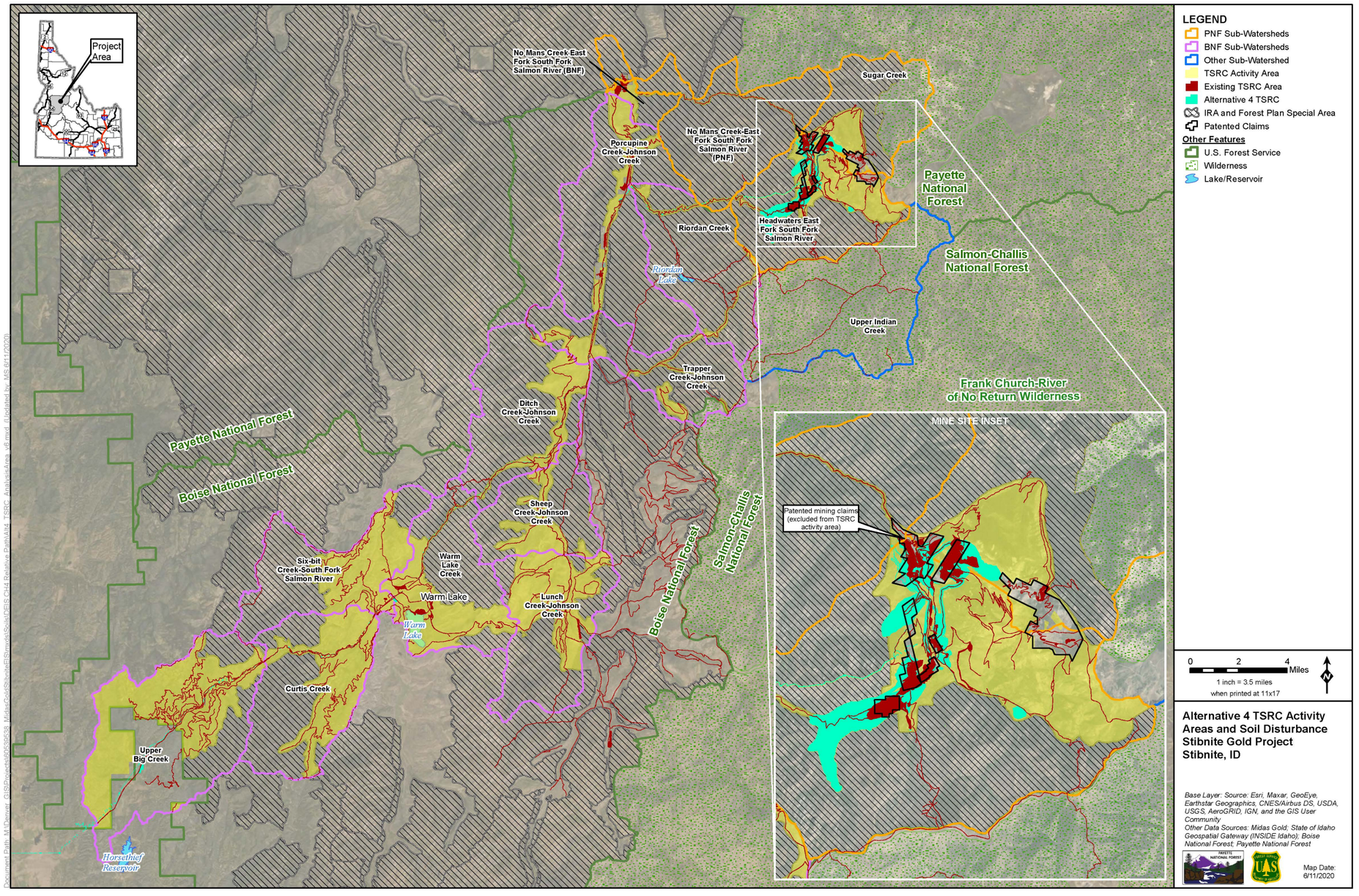

Figure 7 Alternative 4 TSRC Activity Areas and Soil Disturbance

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Appendix G-3: Soil Horizon Calculations

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APPENDIX G-3

Soil Horizon Calculations

Determination of proportion of O, A, B and C horizons in the GM:

- Average solum thickness for each soil map unit is given in **Table 3.5-1** in Chapter 3 of the DEIS (provided below). Solum is defined as layers that have undergone soil development (O, A, or B horizons; excludes the C). Soil Salvage Report (Tetra Tech 2017).

Table 3.5-1 Dominant Soil Types in the Proposed Mine Site and Burntlog Route

Map Unit[1]	Soil Description[2]	Dominant Soil Suborder[3]	Particle Size Class[4]	Solum Depth[5] (inches)	Depth to Extremely Cobbly or Gravelly Material (inches)[6]	Extent Mapped (acres)
mTC	A	Orthents	Sandy/Loamy -Skeletal	8	15	749
sTC	A	Orthents (stony)	Sandy/Loamy -Skeletal	8	15	112
S45+	A	Orthents (very steep)	Sandy/Loamy -Skeletal	8	15	611
fOD	B	Cryepts	Coarse-Silty	15	30	90
fTH	C	Saprists	Decomposed organic material	>30	>30	89
AoD	D	N/A	N/A	N/A	N/A	442
Other Unsalvageable	N/A	N/A	N/A	N/A	N/A	172

Table Source: AECOM 2020; Midas Gold 2017; Tetra Tech 2017, 2019

Table Notes:

1 mTC = mixed typic cryorthents

sTC = stoney typic cryorthents

S45+ = sandy-skeletal/loamy-skeletal, mixed typic cryorthents

fOD = frigid oxyaquic dystrocryepts

fTH = frigid typic haplosaprists

AoD = areas of previous disturbance

2 A Somewhat excessively and excessively drained soils developed in residuum and colluvium derived from igneous intrusive rock (granite, granodiorite, quartz diorite, quartz monzonite, and others). Map unit S45+ includes some areas of previous disturbance (AoD) on slopes greater than 45%.

B Very deep to bedrock, somewhat poorly drained soils developed in recent silty alluvium near stream channels.

C Very deep to bedrock, poorly and very poorly drained soils developed in organic materials in foot slope and toe slope positions subject to groundwater seepage.

D Areas of Previous Disturbance – No Salvageable Soil.

N/A = not available

Table Notes (Continued):

3 From *Soil Taxonomy* (U.S. Department of Agriculture, Natural Resources Conservation Service 1999). Orthents (Entisols) have less soil development compared to Cryepts (Inceptisols). Orthents typically have a surface A horizon over a C horizon composed of weathered granitic material. Cryepts also have a subsurface B horizon with evidence of soil development. Saprists (Histosols) typically have highly decomposed organic materials deeper than 16 inches.

4 Skeletal classes have >35 percent (%) coarse fragments. Sandy = loamy sand or sand textures. Loamy = generally loam, sandy loam, and silt loam textures with <35% clay. Coarse-Silty has <35% coarse fragments, <15% fine sand or coarser, and <18% clay.

5 The solum includes all soil layers that have undergone soil forming processes, including the O, A, AC, and B horizons. It excludes the C horizon.

6 Estimated at >60% coarse fragments by volume.

Mine Site

- Total combined GM salvaged from mine site is 1,884,072 (RCP Table 3-6; Tetra Tech 2019).
- Soil map unit fOD = 326,700 CY of GM with salvage depth of 30 inches
    - Solum depth is 15 inches, mostly A or B horizon = 163,350 CY
    - C horizon = 163,350 CY
- Soil map unit fTH = 454,960 CY of GM with salvage depth of 36 inches
    - Solum depth is 36 inches, all O horizon
- Soil map unit mTC = 1,102,412 CY of GM with salvage depth of 18 inches
    - Solum depth is 8 inches, mostly A horizon = approximately 489,961 CY
    - C horizon = approximately 612,451 CY
- Approximate proportions by horizon are:
    - O horizon = 454,960 CY (24%)
    - A and B horizon = 653,311 CY (35%)
    - C horizon = 775,801 CY (41%)
    - C horizon material also can be broken out by alluvium in the fOD unit (which is finer grained and more fertile) vs colluvial or residual material in the mTC unit.
        - C from fOD = 163,350 CY (9%)
        - C from mTC – 612,451 CY (32%)

Burntlog Route

- Based on Table 3-11 in RCP (Tetra Tech 2019):
    - Total of 320,919 CY salvaged GM
    - O horizon = 58,357 CY (18%)
    - A and B horizons = 117,364 CY (37%)
    - C horizon = 145,199 CY (45%)
    - 183,000 CY GM will be placed back for road reclamation
    - 138,000 CY excess GM potentially available for mine site reclamation

Summary

Salvage	O Horizon	A+B Horizon	C Horizon
Mine Site	454,960 CY (24%)	563,311 CY (35%)	775,801 CY (41%)
Burntlog Route	58,357 CY (18%)	117,364 CY (37%)	145,199 CY (45%)
Combined	513,317 CY (24%)	680,675 CY (32%)	921,000 CY (44%)

The mTC soil map unit has an A horizon estimated at 8 inches deep, over a C horizon. Salvage depth is 18 inches, so approximately 44 percent is A material, and 56 percent is C material. This is the same in the mine site and Burntlog Route. The A horizon on slopes under 25 percent would rate fair for reclamation suitability, and poor on slopes over 25 percent. The C horizon material rates poor independent of slope.

Soil Map Unit	Mine Site	Burntlog Route	Combined
mTC	1,102,412 CY (59%)	250,523 CY (78%)	1,352,935 CY (61%)
fTH	454,960 CY (24%)	58,357 CY (18%)	513,317 CY (23%)
fOD	326,700 CY (17%)	12,040 (4%)	338,740 (15%)
Combined	1,884,072 CY (85%)	320,919 CY (15%)	2,204,992 CY

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